

THE ECO-TAXONOMIC APPROACH TO THE STUDY OF BEETLES

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I. Introductory Remarks

The method of approach to the subject by the would be student of beetles is all important to the production of the Coleopterist, and whether he or she is to be a good or poor product will largely be decided by the kind of plan of action or lack of one, which regulates the acquisition of the necessary knowledge and experience. In the present discussion we are not concerned with the preparation for a specialized branch of beetle work, but with the provision of sound bases from which we can build for ourselves in specialised directions after gaining a good general knowledge.

To get to know the beetle fauna of a particular district or country entails at least a book knowledge of the beetle fauna of the country in which that smaller area lies. Thus we are confronted at the start with the formidable task of the identification of specimens observed or collected, knowing at the beginning that they will be amongst the 4690 established species, provided the area of investigation lies in Britain. For the purposes of these notes we will assume an interest in the British species.

We must set ourselves three primary aims for 'getting to know' the beetles.

1. To find out where to look.
2. To find out how beetles live.
3. To be able to identify the different species.

Probably owing to the many factors involved in covering the subject adequately, mainly due to the large number of species, it has been the custom in the past to concentrate upon but one of the above aims with the results that to find out where to look has produced the field naturalist who, for the most part is content to make his observations on country walks and Natural History Society's field meetings. Over a period of years he becomes the experienced field naturalist able to recognise at once the dominant species within the localities with which he has become familiar. He is able to point out much of interest to the younger generation or the new-comer to his district.

Studies of metamorphoses, life histories, or some of the countless aspects of physical development have led to a large proportion of students becoming wholly concerned with the biological branch of the subject, and this branch is specially attractive to teachers and those responsible for courses upon natural science, because single species, or a part of the life of a single species, can form a circumscribed study for individual students, with no lack of such sectional studies available, however many may be

undertaken. Those who spend the whole of their time and energies in finding out how the beetles live become the biologists.

To determine the species, subspecies, biological phase, or other category, to which a name can be applied, appeals to those who are attracted to systematics of the science. This entails a study of the order from the aspect of the classification of its component species, and will inevitably require an extension of the knowledge of the representatives of the order found in the home country, to those throughout the world. Thus, to be able to identify the different species calls for training in the systematics of the order.

Modern trends, particularly the value of isolating all the factors which impinge upon a species within its natural environment, have introduced an advanced school of thought arising from this ecological approach to getting to know a species or group of species. The method referred to has been termed the Eco-system. In so far as the practical example which has been chosen here only partially fulfills the idea of the eco-system, it has been deemed advisable to refer to the method outlined as the eco-taxonomic approach.

Hitherto, the student has been almost entirely dependant upon a few standard works for naming his species of beetles, and each of these works has adopted the plan, established by custom, of segregating the species by differences in structure, many of such differences being so highly specialised as to require long training of the student in the details of the anatomy of the many families and genera of the Coleoptera.

In the literature of the last quarter century, however, the tendency has grown towards the presentation of data which combines the names of the species with details of habits, food plant, plant host and other natural associations connected with the specimens under discussion. The ecological data attaching to British beetles is fast accumulating, but it is only in short notes and articles that it mainly appears, and it is only just reaching the stage of sufficiently covering the British beetle fauna to become of practical help to the student of the Coleoptera. An initial attempt to find the answer to the question of how this mass of information can best be used is discussed below.

The writer, who was residing at Gateforth, near Selby during the period December, 1944, to May 1945, had the opportunity of forming a small collection of the beetles of the area, and with the object of testing the new approach to getting to know the local beetle fauna, adopted the following methods, which may be of interest to fellow students of the order. A description of the work falls under two headings:-

- (a) Field technique.
- (b) The basis for determination.

II. Field Technique.

The primary objective, whilst in the field, is to obtain as much information as possible concerning the natural habitats and the physical condition surrounding the specimens taken or observed. The exact place of capture and the conditions in which each specimen lives, must be noted, and in view of the fact that a single excursion may result in the capture

of perhaps thirty to forty specimens, it is necessary to make a written note about each one whilst in the field. The smaller the number of examples collected and the larger the amount of detail noted about each the better. The above makes it necessary to carry a box containing up to forty small glass tubes so that each specimen can be separately tubed. Each tube should bear a number which is quoted in the filed notebook with extended details of capture. One of the more usual forms of large killing bottles can be carried with advantage for those specimens which are so distinctive as to be remembered without requiring a separate container, if so desired.

The type of information required to be noted mainly comes under the following heading:-

- (a) On soil, sand or mud.
- (b) Under stone or other object on the ground.
- (c) In water and whether swiftly flowing, slow moving, stagnant or brackish.
- (d) Plant host with name of plant species, genus or general description of plant.
- (e) Position on plant, e.g. on leaf, stem, in bark, in wood or at root.
- (f) On flower, blossom, fruit with name of plant.
- (g) In fungi with name of fungus or description and its state of maturity or decay.
- (h) In dung and type.
- (i) In decaying animals and animal matter with type.
- (j) In moss.

Then there are the more general conditions which include geological date, for example the soil and rock formation. The climatic conditions, as well as referring to the actual day conditions, should make reference to the season in the following manner:-

<u>Prevernal.</u>	March to early April up to appearance of earliest flowers.
<u>Vernal.</u>	Mid-April to end of May, trees in young leaf or flower.
<u>Summer.</u>	June to August, trees in full leaf.
<u>Autumnal.</u>	September to November, during leaf fall.
<u>Winter.</u>	December to February, most plants dormant.

The nature of the plant communities, or the details of plant ecology of the areas under investigation should be noted, and as an indication of the extent of this section of our work the following list of plant habitats is given as an illustration:-

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|----------------------|----------------|-----------------|
| 1. Oakland | 7. Grass Moor | 13. Shingle |
| 2. Ashwood | 8. Grassland | 14. Hedgerow |
| 3. Pinewood | 9. Chalk downs | 15. Arable land |
| 4. Heath | 10. Marsh | 16. Rocky Shore |
| 5. Heather Moor | 11. Salt Marsh | 17. Mountain |
| 6. Cotton-grass Moor | 12. Sand dune | |

Each of the above plant habitat types presents to the eco-systematist the picture of different kinds of plant associations the details of which should be assimilated by the Coleopterist from a work upon plant ecology. The above by no means exhausts the possible habitat descriptions and associations but is an indication only of some of the

conditions and situations to be noted in which beetles are found in nature. If we use such habitats, and group the beetles we find in them, we provide ourselves with a classification of habitats, or bionomic key, which divides the total of the species into smaller groups of species. By applying a suitable name to each of these habitat groups we obtain a group name for our captures as soon as they are made. As an example we take some of the habitats listed above for a simplified bionomic key.

BIONOMIC KEY

A. Ground species -		Habitat Group
1. Under stones.....		Lapidicoles
2. On sand.....		Arenicoles
B. On or attached to plants or fungi -		
3. On tree trunks, in or on wood or bark.....		Truncicoles
		Lignicoles
		Corticicoles
4. On stalks, leaves, flowers.....		Herbicoles
		Phyllicoles
5. On moss.....		Muscicoles
6. On fungus.....		Fungicoles
7. On decaying vegetation, flood refuse, etc.....		Detriticoles
C. Associated with animals or man -		
8. In carcasses.....		Cadavericoles
9. In dung.....		Stercoricoles
D. Aquatic species -		
10. In stagnant waters.....		Stagnicoles

Consideration of this abbreviated bionomic key will show that it can be greatly extended to cover more and more habitat groups and natural conditions so that as knowledge of the life histories and associations of a larger proportion of species increases and new information recorded, provision can be made for them by erecting new habitat groups as required. The greater the number of accurately defined habitat groups of species, the less becomes the number of species within each and the greater the facility for determination.

Where the association is with a plant, every effort should be made to obtain the name of the plant, and if it is a species unknown to the coleopterist, he should take with him a flower, fruit or leaf for determination by a botanist, making a descriptive note of the general characters of the plant. Beetles which are found in hibernation should be noted as in that condition, for their natural habitat whilst in full activity might be quite different. This discussion being intended to apply to fully adult beetles only, it will be appreciated that in cases where the adult has only just emerged from the pupal stage its situation is often different from that which applies to the imago in full activity. In such cases the recorded habitat will reflect the stage of development.

In order to use the information relating to habitat or host, etc., in the manner described, some experience must be gained in separating the natural habitat from the chance situation, for the possession of the powers

of flight by so many species of beetles brings them at times into situations which are both strange and incongruous. The recurrence of a particular species within the same type of habitat quickly enables the investigator to discriminate between the true natural habitat and the chance situation.

III. The Basis for Determination.

On mounting up the specimens brought back from the field excursion it is necessary to co-ordinate the notes in the field notebook with the specimens to which they apply, and this can be simply done by transferring the number of each specimen, as shown on the tube in which it has been placed, to the card upon which it is mounted. If it should be a pinned specimen then its number can be written upon the locus label, and the date of capture will always be sufficient future reference to the correct batch of field notes (always dated) in the field notebook.

The next problem representing aim no. 3 is to get the material named by the eco-taxonomic method. The collecting of the specimens and the compilation of the ecological notes has been completed in accordance with the foregoing principles, all the specimens having been taken in the Gateforth and surrounding districts. The specimens were then considered one by one together with the appropriate field notes, and worked out with the aid of a bionomic key, on the lines of the one quoted above. (The actual key was much more extended one covering twenty habitat groups, but space does not allow for the extended scheme to be covered in this paper.) A copy of the latest check list of British beetles (Kloet & Hincks) had been marked up with numbers opposite every specific name representing the habitat group number of each species, and where a species occurs in more than one of the habitats listed, all the group numbers in which it occurs were quoted. The only species not covered were those marked "very local", "rare" or "very rare" in the standard works on British Coleoptera. The habitating of the British species was accomplished from all the available literature on British beetles as well as from the previous records and the past experience of the writer. This was followed by the compilation of separate lists of the species of each habitat group. The collection of specimens was then divided into habitat groups and taken group by group, and with the aid of the appropriate group list of species, was worked out with the standard taxonomic literature.

To bring this system to full development entails the preparation of diagnostic keys to the species providing a separate key for each habitat group. But even without such keys, the advantage to the future student of the beetles, through reducing the mass of species to smaller groups for working out purposes must be obvious. As an experiment habitat group keys have been drawn up and found greatly to facilitate determination, if not always to the species, then to the genus. After testing these keys will be published for the use of those students interested in this new approach.*

*BOOK NOTICE

Field Book of Beetles, by J. R. Dibb, A. Brown and Sons Limited, London,
\$ 4.00 U.S. currency. [21/- net.] 1948. 197, xxv. 14pd. 182 figs.

This book is a well illustrated guide to the beetles of the British Isles, employing the system outlined by Mr. Dibb in the preceding article. [ED.]